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Magnetometer for absolute magnetic (field) flux density measurements - has container with two ampoules for working substances separated by e.g. organic radical

URALS MATERIALS SCI TOOLS INST 92.12.28 92RU-015899
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Magnetometer comprises light source (1), fibre optical light guide (2), photodetector (3), resistor (4), capacitor (5), inductance coil (6), device (7) with the working substances, magnetic measured field modulation coils (8), modulation generator (9), diode (10), narrowband amplifier (11), synchronous detector (12), recorder (13), wideband oscillator (14) and frequency meter (15). The light beam modulated by oscillator (14) passes via the system to coil (6) to set up a linearly oscillating field. When 2pifo!=gamma.Bo, fo being the field resonance frequency, gamma the gyromagnetic ratio of a proton or electron and Bo the measured field inductance, device (7) absorbs the coil magnetic energy, changes its Q-factor and so changes the current through the coil and the volt drop on resistor (4). An absorption resonance curve is formed whose width depends on the interatomic interactions of the working substances.

Current of frequency Fm greater than fo modulates the measured field in coil (8) and a derivative absorption curve is obtained from diode (10). The NMR or EPR signal is amplified (11) for the detector and recorder. The device (7) has two ampoules, one inside the other, the space between them filled with an organic radical having a narrow resonance line or with a paramagnetic salt giving an EPR signal, while the inner ampoule is filled with e.g. an aqueous sol ution of MnSO4, giving the NMR signal. The introduction of paramagnetic Mn+ ions reduces the protons relaxation time and prevents RF field saturation of the sample. The working substance is selected in a 1 to 1 relationship by volume, reducing filling of coil (6) with one substance and so reducing the signal-to-noise ratio.

USE - For absolute measurements of magnetic field inductance over the range 0.3.10power -4 T - 16 T using a single sensor.

ADVANTAGE - Magnetometer enables absolute measurement of inductance over a wide range of magnetic fields using fundamental constants - the gyromagnetic ratios of an electron and proton. The sensor is far enough from the measuring unit to make attenuation in the optical fibre light guide insignificant. (3pp Dwg.No.1/2)

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